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Extended Written Testimony
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Marshfield Clinic for

The Hearing on Health IT Safety of
The Adoption/Certification Workgroup of the HIT Policy Committee

Hearing date February 25, 2010

This testimony is presented on behalf of the physicians and staff of Marshfield Clinic, who thank you for conducting this hearing on patient safety issues related to promoting the adoption and use of health information technology. We appreciate the opportunity to share our views regarding the potential for HIT to revolutionize health care and provide the necessary decision support to incorporate evidence based decision making into clinical care processes. My name is Justin Starren. I am a physician-researcher who specializes in the field called biomedical informatics. I make my living studying how the availability and presentation of information to patients, physicians, nurses, and other members of the healthcare team can improve healthcare.

Before addressing the specific questions, it is important to note that the chartless, electronic healthcare workflow at Marshfield Clinic relies primarily on software that has been developed over the past four decades by Marshfield Clinic itself. Vendor components are integrated where they are able to provide necessary functionality and a reasonable cost. Since the 1960's, EHR development has been championed by the physician leadership of the Marshfield Clinic, and done in close collaboration with our practicing clinicians.

We have developed these systems because the consensus opinion at Marshfield Clinic is that well-implemented EHRs dramatically improve patient safety over what can be achieved with paper-based care. Today's HIT is focused on managing heath care events, the next generation of HIT will be able to manage entire, complex health care processes. Although the questions submitted, and our answers below, focus on potential safety issues with existing software, the deeper HIT-related patient safety concerns at Marshfield Clinic are about how to get to the next generation of HIT tools. It is also important to note that Marshfield Clinic also licenses its EHR to other healthcare providers; therefore, the Clinic is both a healthcare provider and a vendor.

At this end of this document, I am including additional information on the Marshfield Clinic and its EHR.

What experiences have you had with EHR-associated patient safety risks?

The term "EHR-associated patient safety risks" carries with it an implication that such EHRs create, cause, or worsen such risks. Marshfield Clinic has invested in the development of HIT systems for over four decades because the consensus opinion at Marshfield Clinic is that well-implemented EHRs dramatically reduce patient safety risks over what can be achieved with paper-based care.

Let me share a personal example. I take Coumadin, a blood thinner. Coumadin is extremely difficult to manage. Take too much and you can bleed into your head and die. Take too little and you can have a blood clot and die. The goal is to take just the right amount. To make matters harder, the "right amount" varies over a factor of 10 from person to person, and can change with diet, medications and other factors. The Marshfield Clinic has an anticoagulation service that uses our HIT tools to manage patients on Coumadin. Recently, I also needed to take an antibiotic. My doctor selected one that has less interaction with Coumadin. By the time I got home with my antibiotic, there was a message on my voicemail from the anticoagulation service saying that, given my overall health picture, I should get an extra blood draw to check if there was an interaction between the Coumadin and my antibiotic. I did; there was; and my Coumadin dose was adjusted while I was on the antibiotic. Keeping ones anticoagulation in range is a very real patient safety issue. The level of care I got would not be possible without an EHR.

I recently asked the providers at Marshfield Clinic to comment on the ways that our EHR contributes to patient safety. I received pages of emails. A few of the comments included:

- "Because of the EHR … we were able to abort an unnecessary, expensive transfer, probably by ambulance or even Helicopter, in the middle of the night."

- "Med manager [the medication management part of the Marshfield EHR] has significantly decreased the risk of serotonin syndrome in my patients."

- "Meds manager alerted me to the new anti-seizure medication she was on and indicated her drug levels might significantly decrease on hormones. I avoided a potential problem."

- "Our nephrology practice is geographically diverse but linked by EHR. When receiving calls to problem solve data can be accessed during routine phone conversations to confirm lab data, medications, allergies, immunizations, dialysis prescriptions, recent encounter notes and recent hospitalization records. This ensures accuracy, improves efficiency, and likely decreases office and hospital visits for patients."

- "There is no question that our EMR [sic] has advanced patient safety in our dermatology practice."

- "Every month that I am on call, covering for my partners, I am asked to make decisions about patients I don't know. With EHR, it doesn't matter if I'm home, at work, in hospital or anywhere with internet access, I can look up what other medications patients are on before adjusting doses. "

- "[The] EHR improves the safety of each patient at every visit."

The anecdotes are confirmed by the numbers. For example, using these tools in our hypertensive patients, we increased the fraction controlled from 44% to 66%. This means 11,881 more patients under control. Various studies suggest that one needs to treat between 29 and 167

hypertensive patients to prevent one stroke. That converts to between 71 and 407 strokes prevented over a five year period.

In spite of this, I do not believe that EHRs are a panacea. I was co-chair of the American Medical Informatics Association policy summit on "Anticipating and Addressing the Unintended Consequences of Health Information Technology and Policy" because I understand that Health Information Technology (HIT) does not exist in a vacuum. It is embedded in an extremely complex socio-technical system. The healthcare workflow is notoriously complex. There are many different participants with roles that change, not only over time, but also with the clinical situation of the patient. The addition of technology to healthcare changes that workflow, often in unpredictable ways.

Many discussions of patient safety and electronic health records (EHRs) ignore the fundamental premises of both Human Computer Interaction and Complex System Analysis. That premise is that most errors or failures cannot be attributed to the single failure of a single component. Most errors occur because of unexpected interactions: between human and computer; between one computer and another computer; or, between one human and another human.

An excellent example of this sort of interaction outside of the EHR realm was the widely publicized issue with Heparin dosing. In this case, patients received dangerously high doses of Heparin. The bottles of heparin were CORRECTLY labeled. The human picked up the wrong bottle. In retrospect, it became apparent that the two different strengths of heparin had labels which were so similar that they were easily confused by harried hospital staff. The solution to the problem was to change the labels on the various Heparin solutions to make them more obviously different. By themselves, the original labels had no errors or incorrect information. It was only when a human interacted with the label that errors occurred. More over, these errors did not occur every time a human read the label, the error only happened occasionally.

When a line of inquiry is of the form: "Was there a problem? Did you tell the vendor? Did they fix it quickly?", that inquiry contains an implicit assumption that the "problem" is some type of discrete "software bug" that can be "fixed." An example of such a bug would be if the doctor selects one medication on the screen and the system records a different medication in the database. While such bugs do occur, the experience of experts in the field is that such discrete software errors represent a tiny fraction of the total events that occur. More often, the untoward event has multiple, interacting contributing factors.

In reviewing this issue with senior staff within the Marshfield Clinic, three cases were identified. All of these demonstrate the principle of complex interaction. One, about five years ago, involved a laboratory analyzer that received a software update from the vendor which changed the formatting of results sent electronically. When this new format went across the electronic interface into our EHR, the results were garbled. Both the analyzer and the interface were functioning as designed, however, their interaction caused the problem. The analyzer was taken off line until the interface could be updated. The second instance was related to a commercial drug-drug interaction system used as a component of our EHR. The system supports multiple sensitivity settings. When the system was set to the most sensitive level, it resulted in alerts occurring for drug-drug interaction that were so rare and obscure, they were not present in either the drug insert or found by a Medline search. It was felt that this deluge of alerts could cause provider to miss high-probability, or severe interaction. The alerting sensitivity was reset to a more reasonable level. In neither case was actual patient harm identified.

Marshfield Clinic physicians practice in a number of hospitals. Several of those hospitals have vendor CPOE systems. Many of the complaints we received concerning commercially available CPOE software occurred prior to January 2008 and caused us to more carefully and incrementally implement physician order entry. The third incident occurred in this setting. The most serious incident resulted in a patient receiving the wrong dose of a medication and was related to the absence of a decimal point in the potential doses available to the physician. The vendor had removed the common dose desired by the physician from the application, but did include another dose that would have rarely been an acceptable choice for any patient. That is why the physician did not notice the lack of the decimal point, because the appropriate dose would have been the number with a decimal point. Similar events have been reported at other institutions where suboptimal choice of options can lead to incorrect selections from a list.

How have you identified those risks?

There are two primary areas where risks due to software can be identified. The first area is while the software is under development. Marshfield Clinic includes providers in the development or significant change of any software module. The software is developed iteratively with these core users until satisfactory. It is then reviewed by a larger group of clinicians to detect areas of concern. From there, it moves out to a small pilot group of users. Because these pilot users are acutely aware that they are evaluating the software, they are on guard for any possible issues. Software versions are then iterated with these pilot users until found adequate. Only after sign-off by the pilot users, does the software move into general distribution.

The second, and fortunately rare, area where risks are identified is after software is in production. For software in production, HIT-related patient safety issues can enter the process in either of two ways. They can be reported through our help desk, or can be reported through a clinical incident report. We are not aware of any HIT-related issues that have entered the system solely through clinical incident route. The vast majority of HIT issues (both major and minor) are submitted through our helpdesk system. Both online and telephone input is allowed. All help desk staff are instructed to immediately escalate any issues to the manager in charge of that software, the director of software development and the director of software quality. A rapid assessment is conducted. If the assessment concludes that there is a plausible risk to patient safety, whether or not harm has occurred, the software version can be removed from production and "rolled back" to a previous version, often within minutes. Following the emergent actions, the incident will be reported to the Chief Medical Officer, the Chief Medical Informatics Officer and the Chief Information Officer. If subsequent analysis concludes that the HIT issue represented a real risk to patient safety, a clinical incident will be submitted to the legal department (irrespective of whether actual harm occurred). This emergency system has only been activated twice in the past five years for Marshfield Clinic internal software (as detailed above).

What steps have you taken to prevent harm or to mitigate the safety risks?

The experience at Marshfield Clinic is that several behaviors are critical to minimizing HIT risks. The first is to involve clinic users throughout the design and development of any software component. Second, don't rush. Software modules are revised and redesigned many, many times before they go to pilot, and often many more times before going into widespread production. It is typically several years from vision to production. Fitting EHR software to a clinical workflow remains an art. In spite of 40 years of experience, we still have to make

significant improvement about one third of the time to our systems after they go into production. Third, develop a culture where IT works *for* the providers, and is responsive to their needs. Any helpdesk call from any provider about anything related to the HIT is taken very seriously. Some of these are as minor as the need for a new battery for their mobile computer. Others are major issues as described above.

What approaches would you recommend to prevent or mitigate harm associated with the use of EHRs?

In answering this question, I want to separate the answer into two parts. The first relates to identifying and addressing problems with existing systems and the second relates to anticipating and preventing such problems.

As I discussed previously, the majority of problems are the result of the interactions of complex factors. To identify problems and their causes, the challenge is to tease apart those factors. That challenge is increased significantly by the fact that HIT systems are used by people, and people occasionally make random mistakes. The media is currently full of stories about recalls of millions of automobiles to correct defects. What is easily forgotten at such times is that automobile accidents happen everyday, and that most of those accidents are not due to a correctable defect in the automobile itself. The challenge in HIT, as in automobile safety, is to separate the random from the non-random—to find a pattern of events amid the random errors. Finding such patterns requires data. The more random noise in the data, the more data one needs in order to find the pattern. In the cases of both automobiles and air travel, one solution has been to pool data from across the country. That, however, is not a panacea. Although we track automobile accidents, we do not have a comparable system for tracking unexpected automobile behavior that does not result in an accident. To improve HIT will require data, not only on the obvious adverse events, but also on the near misses. The Aviation Safety Reporting System is often cited as an excellent example of near miss reporting. That system has three critical factors that need to be considered for any system designed to address patient safety issues in HIT.

Those three factors are:

- Third party reporting. The data should be collected by a third-party other than the care provider organization or the software vendor. This improves trust by both those reporting and those analyzing the data.

- Confidentiality. Confidentiality in reporting encourages those reporting to be more comfortable in disclosing the information

- Limited liability projection. Given today's litigious healthcare environment, and the complex nature of most HIT problems, neither care providers nor vendors will be anxious to submit reports if doing so becomes an invitation to legal or regulatory action.

The second part of this answer involves anticipating and preventing problems before they occur. More than anything else, this requires acceptance of the difficulty of the tasks ahead. Implementing HIT involves organizational change. Organizational change is hard; it is slow; and, it is an art, not a science. As a nation, we need to be very cautious about setting HIT standards that are too much of a stretch.

For example, in spite of the fact that we have been operating a chartless workflow, utilizing a CCHIT certified system, for several years, we believe that achieving the goal of 80%

Computerized Provider Order Entry (CPOE) will be a difficult goal for the Marshfield Clinic. Our experience is that CPOE is even harder in the outpatient setting than in an inpatient one. This is because the outpatient realm is more diverse than an inpatient setting. Within a given hospital, one knows where each test will be performed and what the options are. Outpatient providers often interact with a large number of different ancillary service providers, each with different sets of options. Developing an order entry system that accounts for every possible variation, while still having selection menus that are less that a mile long, is at the limits, if not beyond, current HIT capabilities.

This requirement highlights the trade-off between increasing clinical face-time with a patient and increasing clinician face-time with the EMR. Both the physician shortage and the Medical Home initiative are resulting in increasing use of multidisciplinary teams, in which clinicians are teamed with medical assistants. Marshfield has made extensive and successful use of such teams. Forcing the clinician to be the only one who enters orders breaks the workflow of such teams and takes time away from the clinician-patient interaction. Even though we have an electronic workflow, Marshfield Clinic addresses this conflict by delegating various order entry responsibilities to medical assistants of different specialties. Any time that a software system is in conflict with an effective workflow, the risk of patient safety issues increases. Although there are potential advantages of having the clinicians interacting directly with the computer (so they can benefit from decision support) the reality is that current CPOE and user interface technologies are still fairly primitive. Decision support technology is also in its infancy. Consequently, much of the potential benefit cannot yet be realized. Because outpatient clinicians are interacting many times per day with the same medical assistant, there are many chances to deal with any alerts that may be encountered by the medical assistant. This is very different from the inpatient environment where a clinician will round, write orders and disappear. With current technology, increasing provider-computer interactions typically means decreasing provider-patient interactions. Any policy that has the side-effect of decreasing provider-patient interaction must have proven compensatory benefits. There is little, if any, evidence that an 80% level of outpatient CPOE will provide any proven benefits over a lower level.

Studies of IT disasters frequently cite the presence of unrealistic goals and/or unrealistic deadlines as significant contributors. Our experience at Marshfield Clinic is consistent with this. Pushing an implementation forward when either the software or the human organization are not ready almost always portends problems.

What are the benefits and concerns about making those risks and/or adverse events publicly known?

At the Marshfield Clinic, our health care providers are very quick to speak up when they encounter something in our software which they think could be better, ranging from the color of a button to the development of a completely new functionality. This outspoken-ness is part of the Marshfield culture, and critical to the continued development of our systems. We also realize that such openness is not characteristic of all health care provider organizations or relationships with all vendors. It is our belief that the open exchange of ideas is critical to the development and maintenance of optimal systems.

When he spoke at my conference on Unintended Consequences, Dr. Blumenthal called for "the creation of a learning community" within HIT. We need to learn collectively from all of our experiences. That can only happens if we are free to share our experiences, good and bad,

without fear of retribution. Any reporting system that takes a punitive approach will stifle this open exchange and will, ultimately, lead to self-protective behavior and inferior systems.

Closing remarks.

If someone were to give Marshfield Clinic infinite funding and infinite staff and told us to design the one "perfect EHR", we could not do it. Health care workflow is not completely understood. Even if it were, there are trade-offs in the design of any system. The more items you display on the screen, the greater the likelihood that the critical data item will be on the screen when you need it, but the greater likelihood it will be missed in the clutter. The more choices in a pick-list, the greater the likelihood that the optimal choice will be in the list, but the harder it is for the user to find it and select it. We also know that the optimal trade-off point is different for different users. There are many different clinical specialties, different care environments, and different patient populations. There is no one, best EHR design for every clinician. Unfortunately, giving users infinite control is not the answer either. Studies have shown that computer systems that are preferred by users may not be the most efficient or the most error-reducing.

Although much of my research involves studying the problems that occur when people interact with computers, I have no doubts about the overall benefit of EHRs. For my own personal safety, I prefer a physician *with* an EHR. One of our physicians my have said it best, "There are moments where I want to drop the computer out the window, but I would much rather work here than anywhere else. I couldn't go back to paper charts".

Please let me conclude by thanking the Workgroup for the opportunity to present this testimony.

Appendix: About the Marshfield Clinic

This document will summarize the following: (1) After nearly 40 years of IT development work and expenses approximating three to four percent of its annual budget (currently at $950 million/ year) Marshfield Clinic has completely converted to an electronic record format and is paperless in all of its 56 facilities. (2) Marshfield Clinic invested in the technology out of a conviction that the pace of scientific discovery, the pressure for increased productivity, and the intellectual demands of the practice of medicine vastly exceed any individual's capacity for the timely processing all of the pertinent clinical information about a patient, and the provision of state of the art care. To provide anything less would compromise patient safety and care.

Marshfield Clinic (the "Clinic") is the largest private group medical practice in Wisconsin and one of the largest in the United States. It is one of only a few large independent not-for-profit, tax-exempt medical clinics in the United States. The Clinic is engaged in providing quality health care, health care education, and medical research. The Clinic owns and operates outpatient clinical, educational, and research facilities with its main clinical facilities and administrative offices located in Marshfield, Wisconsin. The Clinic currently employs more than 779 physicians and 6500 additional staff. The Clinic has 55 regional centers in addition to the Marshfield location and operates in 37 Wisconsin communities throughout Central, Western, and Northern Wisconsin, which is a predominantly rural area. Marshfield Clinic has developed and acquired sophisticated tools, technology, and other resources that complement and support the population health management mission and strategy of the Clinic. These include an electronic medical record, a data warehouse, an immunization registry, and an epidemiological database that enable enhanced definitions of disease states, diagnoses or conditions, and cost analysis of CPT level interventions. Marshfield Clinic's 56 regional centers are linked by common information systems. With this infrastructure, the Clinic is presently publicly reporting clinical outcomes, and providing physicians and staff quality improvement tools to analyze their clinical and business processes, eliminate waste and unnecessary redundancies, and improve consistency while simultaneously reducing unnecessary costs. The Clinic's largest facilities are adjacent to St. Joseph's Hospital of Marshfield, Inc., a 524 approved-bed acute care and teaching hospital, which is owned and operated by Ministry Health Care, Inc., a tax-exempt organization, headquartered in Milwaukee, Wisconsin.

We believe that health information technology has the potential to significantly increase clinical care efficiency by reducing costs and increasing value (defined as quality/cost) by enabling providers to manage information. To the extent that a provider can manage what he/she can measure, HIT enables performance measurement and the improvement of patient care outcomes. In many, but not all avenues, improvement in patient care also leads to efficiencies and savings, primarily through reductions in hospitalizations, readmissions, and the utilization of intensive services.

Description of the Marshfield Clinic electronic medical record

Marshfield Clinic is unique in that is has developed its own electronic health records and ancillary reporting systems over the last thirty years. The system, called CattailsMD, was the first internally-developed system to gain CCHIT certification, and has recently been made available for resale in the EHR marketplace.

The clinic first implemented an EMR in 1985, and over time the practice has promoted adoption of the full functionality of the system. Since 2003, Marshfield Clinic has been deploying portable wireless tablet computers that led to a chartless medical environment by the end of 2007. All physicians and their support staff now use the tablet computers, which are linked to the Clinic's electronic medical record. With wireless computers, providers can instantly access confidential medical history, radiology reports and images, test results and expert opinions. They can take notes, enter orders and write prescriptions electronically. Our physicians say that their practice is much more organized and efficient with the use of the tablet. It brings what previously was only available at our desktop into the exam room.

Our physicians can track blood pressure readings and lab results on tablet computers and check which preventive screenings, such as mammography or colonoscopy, are due. They can show their patients diagrams or streaming video of procedures they may under go.

Storing, retrieving and updating paper charts is time-consuming and costly. Exam room access to electronic records enhances patient security, reduces errors and eliminates duplicate tests, all of which allows us to provide better care. We estimate that the elimination of pulling paper charts alone has resulted in a $7 million savings annually. Patient medical records are accessible to those who need to know throughout the Marshfield Clinic system, and will be available at the Clinic's affiliated hospitals.

Providers can instantly print out patient educational materials rather than leaving the exam room to search for information. When a provider can take the time to educate patients about diseases, risk factors and recommendations to improve their health, patients are more likely to comply. The ability to quickly get information clearly improves the quality of the patient visit.

In order to assist with our quality performance, the Clinic developed a comprehensive package of initiatives that leverage the electronic technologies to redesign care for chronically ill patients, to identify improvement opportunities, collect needed information at the point of care, and report performance back to physicians.

For example, our PreServ (Preventive Services) System is able to alert physicians when preventative services are due for a patient during a visit with a primary care manager. In PreServ, the EMR generates a preventive services (PRESERV) list on the dashboard of each electronic patient record. This box compares the patient's clinical profile with evidence-based clinical practice guidelines formed from a number of sources including the ADA and input from endocrinologists at Marshfield, and highlights (in red) gaps in care related to preventive services, immunizations, routine screening, and diabetes care needs; eventually, this functionality will be expanded to cover additional disease states. The system prompts the physician to provide or schedule needed preventive services during the patient visit. In contrast to disease-specific programs and care registries, this list allows physicians to proactively plan and coordinate needed preventive, screening, treatment, monitoring, and education across a spectrum of diseases for each individual patient.

Our EMR also includes a system for flagging high-priority patients. A "hierarchical defect recovery list," which acts as a safety net, includes high-risk patients with multiple chronic conditions that are in need of immediate attention. High-risk patients with serious gaps in care (e.g., diabetes patients who have not made appointments for annual eye and foot examinations and whose hemoglobin A1c level is above goal) appear at the top of the list; physicians and staff use this list to work with the patient to provide or schedule needed care immediately. When a diabetic patient visits a physician for example, he or she is notified of the need to conduct a foot

exam. Physicians are then provided "Clinical Storyboards" showing their performance with selected quality measures such as foot exam compliance. Since starting to measure and report these key quality areas, we have seen increases in percentage of patients at goals, that are specified in public reporting for key areas such as hypertension, diabetes, congestive heart failure, and coronary artery disease.

We have also implemented an anticoagulation care management system. All patients who take the drug, Warfarin, which is a high-risk medication with a narrow therapeutic threshold, are managed under a single set of protocols. Under this nurse-managed, physician-directed telephonic management program, nurses place outbound calls to patients to discuss their anticoagulation management and check on their general health. As needed, nurses adjust dosing based on written protocols and enter updates into the EMR.

The Clinic has also implemented electronic prescribing to enhance safety. Physicians use tablet PCs for electronic prescribing, with prescriptions printed by computer, thus reducing the potential for medication errors.

We have implemented a 24-hour nurse line. Patients have access to a 24-hour telephone number staffed by nurses. Nurses listen to the patient's concerns, refer to the EMR for background data and care plan, offer advice, and triage patients for physician appointments using physician-approved guidelines. An automated e-mail system notifies physicians whose patients have called the nurseline and provides a hyperlink to the patient's medical record.

The Clinic is also utilizing the system to facilitate ongoing quality improvement efforts including continuing medical education, online provision of care guidelines, feedback and education by quality improvement medical directors and clinical nurse specialists, and sharing of comparative data on performance and best practices. The EMR facilitates many of these efforts by allowing physicians to collect data on quality thereby providing timely, actionable feedback on individual performance.

One way we leveraged our information systems to help reduce costs and hospitalizations was to identify patients who are not well managed in one or more critical quality areas. To address this problem Marshfield Clinic developed software tool called "iList" (Intervention List), which is used in primary care including Internal Medicine, Med-Peds and Family Practice departments. iList originates from the electronic medical record and provides a list by provider of patients who have one of three chronic illnesses – diabetes, heart failure or hypertension – and who do not meet all of their recommended health goals. iList is a tracking tool intended to help providers identify and reach out to patients who are overdue for services and are not meeting their quality of care goals. iList proactively assures that our patients get the care they need to try to help provide better control of their chronic medical conditions. Our physician and their assistants use iList to be sure patients, especially those with diabetes, have lab work and follow-up visits when needed. In the past, patients might not have understood they needed to come in more frequently because they have diabetes. iList is highly sophisticated reminder system, and can help physicians examine their practices realistically and take action to improve care where there may be gaps. Our physicians have found that using it has been an eye-opener as far as putting a face on those patients who could be slipping through the cracks. Physicians are typically trained to take care of an individual patient and are not typically trained in the management of populations of patients. Using tools such as iList have allowed us to improve our performance on the quality metrics reported and more importantly the health of our patients as evidenced by decreased hospitalizations in some chronic conditions. For Marshfield Clinic to be competitive on the

basis of results, we need to know what our results are. This helps bring results to a patient level and lets us know where we stand on quality measures.

iList is not a registry. Patients who are on target for their health goals do not appear on iList and it is not a registry of all of a provider's patients or a listing of all patients with a specific condition. Only patients who have not achieved a specific quality measure or who don't have a future appointment will show up at any given time, and once they meet their goals they are removed from the list. iList may be viewed as being a subset of a registry, which would include all of a provider's patient population. The patients listed on iList are patients not on target for their monitored quality health metrics.

Provider-approved protocols make iList unique. Key to understanding iList's potential, and part of what makes it different from other Information Systems tools, is provider-approved protocols built to accompany the application. The step-by-step written protocols – derived from evidence-based medicine in the Marshfield Clinic guidelines for hypertension, heart failure and diabetes – delegate interventions and actions to be carried out by medical assistants and other support staff.

The protocols may be used as part of a patient-specific plan of care from the patient's primary care provider. With protocols providing direction, support staff may review the list and initiate actions to help patients reach their goals. Per protocol, for example, support staff may call a diabetic patient to schedule an overdue fasting lipid panel or foot exam. This promotes a team-based approach in the patient care process.

iList exclusions -- Certain patients with chronic conditions may be excluded from the iList application by the provider for reasons such as advanced age, terminal illness or contraindications to the usual care. This ability allows the iList application to individualize care for patients while considering population based measures for quality.

Potential to track other conditions

Development of iList was hastened due to Marshfield Clinic's participation in the Centers for Medicare and Medicaid Services (CMS) Physician Group Practice Demonstration project which began in 2004. In order to improve our performance in the demonstration, our providers wanted the ability to look more closely at overdue services for patients with the three chronic conditions previously mentioned.

Implementation of iList may provide the opportunity to address the way care teams handle planned care workflows. Planned care visits allow for results to be available at the time of a patient's visit to allow direct immediate direction and changes to the patient's care plan. This immediacy decreases the need for repeat visits and decreases rework (letters, telephone calls for communication of results) and for the patient and the practice after the visit. iList makes it easier to provide support to practices to help plan care for patients. This tool takes a huge step in that direction.

The Clinic has also developed additional reporting mechanisms to identify patients at risk of hospitalization (for example, congestive heart failure patients) who qualify to be added to the disease-management program. Once a patient is identified through criteria-driven data-mining, Care-Management staff review the patient's electronic chart and make a determination if the patient meets criteria to be added to the disease-management system. This system provides a worklist and documentation capabilities for the clinical staff to monitor at-risk patient populations, and escalate a patient's condition to a physician if required.

While most of the groups participating in the CMS PGP program also have electronic medical record systems. Marshfield Clinic is unique in that it has developed its own systems and data warehouse. This has allowed the group to customize its software as required and react quickly to meet reporting needs. We went through the typical quality reporting progression: denial that the results are accurate, improvements to data collection, improvement in acceptance of the results, improvements in process and outcomes resulting in clinicians wanting more data, faster. Because we have developed our own systems and data warehouse, we are able to react quickly and fine-tune as required to continually improve our data accuracy and timeliness.

Marshfield Clinic's role as an EHR vendor

Recently, Ministry Health Care, the predominant hospital provider in the Marshfield Clinic service area agreed to use CattailsMD, an electronic medical record software suite developed by Marshfield Clinic, in most of its hospitals and Ministry Medical Group.

The agreement will create the largest patient database in Wisconsin. Under the agreement, more than 1,000 providers in the Marshfield Clinic system, at Ministry Medical Group and Ministry hospital locations, will share access to 2.5 million patient records.

As part of the CattailsMD implementation, Marshfield Clinic will provide planning, project management, training, and technical support to Ministry Health Care. From a technology standpoint, the Cattails system stood out because its physicians liked the tablet platform and had witnessed its success at one Ministry health clinic. Physicians like the Cattails system because it's delivered as a service where Marshfield Clinic hosts the data and manages the applications.

Marshfield Clinic has a very mature data warehouse infrastructure and a world-class bioinformatics research group. Some organizations have gone through very expensive, and time-consuming EMR implementation efforts, but when they were done, they still had nothing in terms of data warehousing and the tools they need to manage clinical outcomes. Ministry's goal was to be proactive and take advantage of the benefits evident in the EHR as seen in the Marshfield Clinic system of care. Rather than wait for the patient to show up in the examination room, with CattailsMD their providers will be able to see which diabetic patients, for example, are overdue for their eye or foot exam screenings.

Summary

The accelerating growth in new medical knowledge, coupled with the birth of new sciences, such as genomics and personalized medicine, suggests that physicians, nurses, and other healthcare professionals will invariably continue to fall further and further behind in their ability to keep up with the latest discoveries and approved treatments. As information technology has sparked this explosive growth in knowledge, only information technology can provide an adequate response. By using evidence-based knowledge embedded in clinical decision support deployed within a well-designed workflow, physicians can manage the ever changing and growing knowledge base critical to the delivery of effective and efficient healthcare.

Health IT on a broad basis is still in its infancy. Looking to what can be achieved in the future due to implementation of these systems should be our focus, and an ongoing oversight function of the Office of the National Coordinator for HIT which must be closely integrated with Medicare reimbursement.